THE BODILY SELF:

THE SENSORI-MOTOR ROOTS OF PRE-REFLEXIVE SELF-CONSCIOUSNESS.

Dorothée LEGRAND

legrand@up.univ-aix.fr

CEPERC - Département de Philosophie, Université de Provence,

29 Avenue Robert Schuman, 13621, Aix-en-Provence Cedex, France.

To appear in:

Phenomenology and the Cognitive Sciences.

Abstract

A bodily self is characterized by pre-reflexive bodily self-consciousness that is "immune to error through misidentification". To this end, the body's double involvement in consciousness is considered: it can experience object intentionally and itself non-intentionally. Specifically, pre-reflexive bodily self-consciousness, by contrast with the consciousness of the body that happens to be one's own, consists in experiencing one's body as the point of convergence of action and perception. Neither proprioception alone nor intention alone are sufficient to underlie this pre-reflexive bodily self-consciousness. Rather, it is made possible thanks to a sensori-motor integration, allowing a sensitivity to the sensory consequences of one's action, through action monitoring.

Key words

Body, self, pre-reflexive consciousness, sensori-motricity, immunity to error through misidentification.

1 – Introduction.

This article intends to provide some arguments about the nature of the self by investigating bodily experience. Specifically, I will argue in favor of the definition of a bodily self, on the basis of an investigation of bodily consciousness. If we accept that (1) we are/have a body and (2) we are/have a self, the question is then the following: is our body (part of) our self, and conversely is our self (part of) our body?

Descartes himself provides an account of this question and argues that the self is not lodged within his body as a pilot is within a ship. However, clearly, in his account, the self is *not* the body; the self is not bodily but (at best) embodied. The embodied self would be a mental self (i.e. a self characterized mentally) "put into" a body, that is, for instance, a self whose mental states would be correlated with bodily (notably brain) states. Although an embodied self would thus have corporeal characteristics, it would not be identical with its body. On the other hand, a bodily self would be a self that is (part of) the body. The body under a certain description would be nothing else than the bodily self.

A lot of contemporaneous researches on "the body and the self" defend a conception of the self as embodied, in the sense that they consider body and self as different entities, even if they grant a crucial role of the body in the constitution of the self. Of course, consciousness and self-consciousness are now most often thought to be anchored in some physical substrate. Notably, an increasing number of empirical researches allow to determine some neuronal correlates of self-consciousness. However, once the body is given a role in the definition of self-consciousness and thus in the definition of the self, a crucial question remains: is there a genuinely *bodily self*, or is there only an *embodied self*, that is, is the self (part of) the body, or is the self (partly) *in* the body? The task of the present article is to specify the nature of the self relative to the body. Specifically, I will argue that the self is not only embodied, i.e. attributed to a body, but that there exists a genuinely bodily self.

To do so, the most convincing way seems to begin with a closer investigation of what is supposed to be the fundamental ingredient of the self, that is, self-consciousness[1]. The self is always conceived, in a way or another, as either the object or the subject of consciousness, or both. To quote only one example: "consider an animal that has no experience or awareness of its actions. It has no access to something that we would call self. We are inclined to say that such an animal has no self. The question of self or personal identity is an issue only for an animal which has some access to itself within the context of its own behavior; access to 'itself' actually helps to make possible the existence of 'its self'. Access (self-consciousness) is constitutive of self" (Gallagher and Marcel 1999, p. 275). Given this acknowledged association of self with self-consciousness, the central questioning of the present paper will thus be the following: Is bodily consciousness a form of self-consciousness? If a negative answer is given to this question, then bodily self-consciousness would only be a by-product of a purely mental self-consciousness. Bodily consciousness in itself would be neutral (i.e. consciousness of *a* body), only associated with self-consciousness in a second step, and then attributed to the self. Hence, an embodied self, as defined above. If, on the contrary, a positive answer is given to this question, that is, if bodily consciousness is a genuine form of self-consciousness (i.e. consciousness of *one's* body as oneself), bodily consciousness would be an intrinsic part of one's sense of oneself. The existence of such a bodily self-consciousness would imply the existence of a genuine bodily self.

Lets specify that the claim here is not that the self is constituted by the content of self-consciousness. Specifically, the claim is not that the self would be bodily if the body was part of the content of self-consciousness. Such an argument would confuse the ontological question of the nature of the self and the epistemological question of the content of self-consciousness. Rather, my claim here is akin to Brewer's: "What can we learn about the nature of the self from the reflection on bodily experience? I will approach this question by

addressing a more specific issue: to what extent does the phenomenon of bodily awareness undermine a Cartesian conception of the self? In other words, what, if anything, can be extracted from the nature of a person's epistemological relation with his body in defence of the commonsense, anti-Cartesian idea of a person as no less basically bodily than mentally endowed?" (1995, p. 291). In substance, the idea here is that only a bodily self can ensure bodily self-consciousness. Indeed, by definition, a genuine bodily self-consciousness is the consciousness of itself by the bodily self. So, far from relying on a confusion between ontological and epistemological levels, this argument simply claims that the subject of bodily self-consciousness is the bodily self. On the contrary, the subject of the consciousness of the particular object that happens to be one's body is the embodied self. A mental self can ensure mental self-consciousness and a certain type of consciousness of the body that would be attributed to the self. Consciousness of the body that happens to be one's own and bodily self-consciousness are not mutually exclusive, but only the former allows to define a bodily self.

To resume, the argument thus goes as follows:

If (1) self-consciousness is constitutive of the self,

And if (2) bodily consciousness is a form of self-consciousness,

Then (3) bodily self-consciousness is constitutive of (a part of) the self,

Which implies that (4) (part of) the body is (part of) the self[2]. Hence the definition of a *bodily* self.

On the other hand,

If (1) self-consciousness is constitutive of the self,

And if (2) bodily consciousness is *not* a genuine form of self-consciousness,

Then (3) bodily consciousness is not constitutive of (a part of) the self,

Which implies that (4) the body is *not* (part of) the self.

But (5) it remains possible to correlate body states with self states (self-consciousness). Hence the definition of an *embodied* self.

In the context of the present paper, I will accept, for the good of the argumentation, the association of self and self-consciousness (point 1 above), since this association remains mostly unquestioned in the relevant literature. Here, I will focus on the second point above: is bodily consciousness a genuine form of self-consciousness?

I will investigate this question through the following steps. First, I will recall the fundamental characteristic of self-consciousness. Second, I will check if bodily consciousness meets this requirement. I will differentiate several types of bodily consciousness, and show that we can determine a genuine form of self-consciousness at a bodily level. Thirdly, I will specify a physiological mechanism underlying this form of bodily self-consciousness. This investigation will allow to specifically characterize a bodily self, rooted in sensori-motricity.

2 – Specificity of self-consciousness.

Most often, self-consciousness means consciousness of one's own mental states. For S. Shoemaker (1996), such a self-consciousness is intrinsic to any mental states. The very fact that I entertain a given mental state necessarily implies self-consciousness, i.e. I know that I do entertain this mental state. Crucially for our investigation, following Shoemaker, the form of introspection that accompanies any mental state is not a form of self *perception*. Indeed, perception would imply the ability to identify and re-identify objects, which here would be the self or its mental states; and the particularity of the form of self-consciousness described by Shoemaker is precisely to avoid this perceptual process of self-identification. This particularity is summarized by the principle named "immunity to error through misidentification" (henceforth simply *immunity*): "to say that a statement 'a is ϕ' is subject to

error through misidentification relative to the term 'a' means that the following is possible: the speaker knows some particular thing to be ϕ, but makes the mistake of asserting 'a is ϕ' because, and only because, he mistakenly thinks that the thing he knows to be ϕ is what 'a' refers to" (Shoemaker 1968, p. 7).

This principle of immunity allows to distinguish a genuine *self*-consciousness from the consciousness of someone who happens to be oneself (Perry 1993; 1998). The former type of self-consciousness is immune and thus implies that the "*who*" question cannot be asked: when you entertain a given mental state, it does not make sense to ask you "who is the subject of the mental state you are conscious of?". For example, lets consider that I am conscious of sadness. If I am conscious of the particular emotion I normally feel when I am sad, then the question: "whose sadness are you conscious of?" does not make sense. This form of self-consciousness is thus immune. If, on the other hand, I am conscious of this sadness by observing, in a mirror, a face drawn with sorrow, the question "whose sadness are you conscious of?" makes sense, since it means "whose face are you observing?" and it is possible that I perceive my twin's face although I believe this is my own. In the case I indeed perceive my own face, I entertain a form of self-consciousness, but it is not immune.

It has to be underlined that immunity concerns exclusively the subject of a given state, but does not secure the infallibility of the content (do I believe *x* or *y*?) nor of the type of mental state (do I believe or desire?). Thereby, immunity can only characterize conscious states that combine two aspects: on the one hand, such conscious states imply the (potentially incorrect) identification of what makes its content; on the other hand, these states do not involve any *identification* of the subject, hence their immunity to error through *misidentification*. Thus, by definition, the self specifically involved in immune self-consciousness is not the object of consciousness but rather its subject. In this sense, immune self-consciousness can be named *pre-reflexive* self-consciousness.

Examples of pre-reflexive self-consciousness can be found throughout the literature on self-consciousness. Most famously, Wittgenstein has contrasted non-immune "I-as-object" and immune "I-as-subject". Pre-reflexive self-consciousness as defined here refers to the "I-as-subject". Wittgenstein gives the following examples of it: "I see so-and-so", "I try to lift my arm", "I think it will rain", "I have a toothache" (1958, pp. 66-67). Analytic philosophy (Perry 1993, Castaneda 1966) argues that the pronoun "I" is essentially indexical, in the sense that no objective characterization of the subject can fully replace it. No process of identification of a given person can entail infallibly that I am that person. On the contrary, I can experience myself as the subject of a given thought, for example, without identifying any descriptive properties of the thinker of that thought. Phenomenology has also contributed to the description of pre-reflexive self-consciousness, although in a very different manner. Husserl and Sartre have both insisted that self-consciousness is not limited to the explicit reference to oneself, as when one recognizes one's own mirror image. Rather, each time an experience is given in a first-personal mode of presentation to me, it can be considered as a form of self-consciousness since it is given as *my* experience. What is called pre-reflexive self-consciousness in this context is not considered as the consciousness of a particular object which would be the self but as consciousness of itself, that is, as consciousness of the subjectivity of experience. (Zahavi 2003). Although analytic philosophy and phenomenology differ on numerous fundamental points, they both recognize as crucial the difference between two types of self-consciousness. In the first one, the self is the content of consciousness, its intentional object. In the second one, on the contrary, the self is the subject of consciousness. In the present article, the notion of pre-reflexive self-consciousness refers to this latter form of consciousness. It can also be adequately named immersed, non-observational self-consciousness (following a terminology notably used in Gallagher and Marcel 1999). The aim

in the present article is to determine the basis of pre-reflexive self-consciousness at the level of bodily experience.

3 – Is there an immune bodily consciousness?

Both analytic philosophy and phenomenology agree that immune pre-reflexive self-consciousness cannot be reduced to any objective description of the self. Given this, self-consciousness and bodily consciousness intuitively appear as contradictory. Indeed, on the one hand, (1) self-consciousness, by contrast with consciousness of someone who happens to be oneself, is characterized by immunity, and (2) immunity is due to a pre-reflexive access to oneself, that does not rely on the identification of the self as a particular object. On the other hand, (3) the body is obviously a physical object, and then (4) bodily consciousness would imply the identification of this body-object. Given such a characterization, bodily consciousness would not be a genuine form of self-consciousness, but only a consciousness of the body that happens to be one's own. And given the constitutive role of self-consciousness, such a position may create the impression that the self is a non-bodily entity: "we are not presented with ourselves in introspection as bodily entities" (Shoemaker 1986) and "when one is introspectively aware of one's thoughts, feelings, beliefs, and desires, one is not presented to oneself as a flesh and blood person, and one does not seem to be presented to one as an object at all" (Shoemaker 1984, p. 102).

Here, this conclusion is challenged: is it possible to account for bodily consciousness in a way that does not contradict self-consciousness defined as immune, or is it only possible to characterize bodily consciousness in terms of consciousness of the body that happens to be one's own, as it may seem at first sight?

A first solution to determine bodily self-consciousness as immune would be to build on the idea that self-consciousness is constitutive of the self, in order to claim that, as well,

bodily self-consciousness is constitutive of the self's body. In this framework, any body one is conscious of would be, by definition, one's own body. However, this solution defines one's own body in relation to the content of one's consciousness, and may thus have a too idealistic flavor to be acceptable form a naturalistic perspective (Cassam 1995). For example, Martin (1995) defines the sense of ownership as nothing over and above the felt quality of sensation, but he still acknowledges that "Just because everything one feels is felt to be part of one's body, this doesn't yet show that everything one feels must be a part of one's body" (p. 274). He adds that "the important point is just to note that such an account [that this sense of ownership reflects facts of a genuine object in the world, rather than a mere phenomenal construction] is required to underwrite the claim that bodily awareness is genuine awareness of one's body, and also to indicate that there is no particular reason to suppose that some such account cannot be given" (p. 282). The ambition of the present article is to provide such an account. Dokic (2003) provides some explanation of "how the sense of ownership can flow from the fact of ownership (p. 333) by contrasting bodily perceptions "from this inside" and "from the outside". This recalls the distinction detailed above between the consciousness of the body as one's own and the consciousness of the particular body that happens to be one's own, which is also accessible to others. The remaining question I intend to tackle here is: what does it specifically mean to perceive the body "from the inside"? Dokic argues that bodily experience is an "eccentric form of perceptual awareness" (p. 341-342) since it would be different both from introspection (non-perceptual self-knowledge) and from external perception (visual, tactile, etc.). I here intend to specify this eccentricity.

Specifically, the dilemma is the following: either we accept to claim that consciousness of a body is by definition consciousness of one's body, but then we run the risk of idealism, or we claim that consciousness of a body is not equivalent to consciousness of one's body as one's own. In the latter case, one may think that consciousness of one's body

could be explained as the consciousness of a body plus an attribution of this body to a specific subject, the mental self. However, this does not fit with the identification-free immune bodily self-consciousness that I intend to determine here.

Shoemaker (1968) himself has provided some answer to this problem. His account relies on a more specific description of immunity. Following his view, bodily self-ascriptions would be circumstantially immune, that is, immune if made on the basis of somatic proprioception, but non immune if made on observational grounds. This would distinguish them from mental self-ascriptions which are absolutely immune, that is, always immune. Shoemaker also distinguishes between *de facto* and logical immunity, that is, between immunity in our current world and immunity that holds in any logically possible world. Following Shoemaker, bodily self-consciousness would be both circumstantially and *de facto* immune. Indeed, it would be due to factual architectural constraints linking the proprioceptive receptors and the brain (at least partly) responsible for bodily consciousness (see also Bermudez 1998). Architectural constraints ensure (letting apart fictional cases) that the body one is proprioceptively and kinesthetically conscious of and this state of consciousness belong to a single organism. However, I would like to highlight that these architectural constraints cannot underlie in themselves consciousness of the body as one's own from the point of view of this body/organism itself. This would be possible only if the organism had access to this architecture, which is not normally the case. Therefore, even if, *de facto*, any time one is conscious of a body, it happens that one is conscious of one's own body, it remains that being conscious of a particular body is not enough to claim that one is conscious of one's body as such. Physiological constraints ensure that proprioceptive and kinesthetic bodily consciousness is possible at all, but something else is needed to account for bodily *self*-consciousness. We saw above that the sense of ownership is insufficient to account for the

fact of ownership. Here, we see that the reverse is true as well: the fact of ownership due to architectural constraints is not enough to explain the sense of ownership.

It is important to highlight that Shoemaker's view of bodily immunity is fully compatible with (and even favorable to) the conception of the self as embodied, rather than as bodily, as defined above (section 1). Indeed, following his account, a mental self would have a privileged access to a particular body, without being that body himself. In this framework, what ensures consciousness of the body is only a secured link between a particular mental self and a particular body. This *de facto* immunity is due to nothing intrinsic to this body/self but to a link between two different entities: a self and a body. Hence the conception of the self as embodied, and not as bodily. Here, I would like to suggest that such a description of bodily self-consciousness is not complete and that another form of bodily self-consciousness is immune in a stronger sense and leads to a conception of the self as bodily.

In fact, a naturalistic solution has to meet two constraints that may seem conflicting: (1) a description of the body as a physical object and (2) a determination of a bodily form of self-consciousness that does not imply the identification of the body as an object. A position considering that bodily consciousness corresponds to the awareness of oneself as being a material object among others would not be satisfactory since it would not meet constraint (2). The reverse strategy that proposes to reconcile the self and the body by considering exclusively the subjectivity of bodily consciousness would also fail, by not meeting constraint (1). The challenge of the present article is to combine these two propositions, by considering the subjective properties of the objective body. In other terms, the suggestion here is that bodily self-consciousness is neither consciousness of oneself as an object nor elusive. Rather, it is consciousness of oneself as a *bodily subject*.

4 – Characteristics of bodily self-consciousnesses.

Self-consciousness at a pre-reflexive level has been characterized above (section 2) notably thanks to the distinction provided by Wittgenstein between non-immune "I-as-object" and immune "I-as-subject". In fact, as it is relevant to distinguish between "I-as-object" and "I-as-subject", we can also contrast body-as-object and body-as-subject. First, the body can be taken as an object of consciousness. Here, one obtains an image of the body, as when one sees one's hand, for example. But bodily consciousness is not limited to this image. Indeed, the body is also the subject of consciousness. This is a very simple observation: there are bodies that are felt, touch, seen… but to feel these objects suppose the existence of a feeling, touching, seeing body. The distinction between body-as-object and body-as-subject allows to distinguish two ways one can be conscious of one's body.

The first way one can be conscious of one's body is through an image of the body. This body image can be obtained visually, when one looks at one's body parts directly or in a mirror, but also through other senses, like touch. This body image is in fact obtained each time the body is the intentional object of one's consciousness. In this case, the representation of the body is the content of one's consciousness. The body image has been differentiated from the body schema (Paillard 1980, 1999; Gallagher 1986). This has been first stated by Head and Holmes (1912) who suggested the distinction between a body image defined as an "internal representation in the conscious experience of visual, tactile and motor information of corporal origin" and a postural schema (or body schema) considered as "a combined standard against which all subsequent changes of posture are measured …*before the change of posture enter consciousness*…" (I underline). As underlined, the body schema is unconscious. For Gallagher (1995), the body schema is extra-intentional, subconscious, subpersonal and unowned. It corresponds to the body as it functions to make perception and action possible; it is thus a set of sensori-motor laws, by contrast with a set of images, which rather constitutes

the conscious body image. The body schema corresponds neither to such an image nor merely to the physiological functions taken in isolation, but takes into account the way the body actively organizes its perceptual experience, in relation to pragmatic concerns (Merleau-Ponty 1945). As stressed out by Gallagher, the body schema provides "constraining and enabling factors that limit and define the possibilities of intentional consciousness" (1995, p. 239) but it remains phenomenologically hidden. "The body schema, understood in this way, is not the perception of "my" body; it is not the image, the representation, or even the marginal consciousness of the body. Rather, it is precisely the style that organizes the body as it functions in communion with its environment" (Gallagher 1986, p. 549). The body schema thus does not correspond to the body lived as one's own (as oneself) that I intend to tackle here.

This description of the body schema as unconscious, though, does not limit bodily consciousness to the body image. Indeed, most of the time, the body is neither completely transparent, as the body schema, nor the object of consciousness, as the body image. Rather, it appears phenomenologically in a pre-reflexive manner. This is what I call here the consciousness of the body-as-subject. It corresponds to the relation of the experiencing body to itself, that is, the experience of the body as perceiving rather than as perceived.

Lets take as an example the experience of touching fingers (Gallagher 2000). The experience of the touching finger is analogous to the experience of the seeing eyes: "Proprioceptively, my touching fingers are also attentively recessive unless I reflectively attend to them, which I can do proprioceptively, visually, or again tactilely. Just as I see *with* my eyes, I touch *with* my fingers. I touch *with* my fingers, I have tactile experience, and I perceive the shape of the object in my hand, precisely when I am *not perceiving* my fingers. The tactile perception of an object is not accomplished through my perceptual awareness of the changing spatial properties of my fingers; awareness of my fingers is not equivalent to my

tactile awareness of the object. The body's mode of being in the perceiving act is more than to be perceived". The body can obviously be an object of proprioceptive, visual, tactile perceptions. However, the specific awareness of the body as perceiving is "always in excess" of the body that is perceived.

The distinction between the consciousness of the body-as-object and the consciousness of the body-as-subject appears clearly in pathological cases of dissociation. This has been shown with deafferentated patients whose ability to locate a tactile stimulus on the skin surface of their body differs whether the pathology has a peripheral or central origin (for a detailed presentation of these cases see Paillard 1999). The first patient, GL, suffers from an extensive peripheral neuropathy. Without visual feedback, she is unable to point with her right finger the location of a thermal or pricking stimulation delivered on her passively displaced left arm. However, she shows an accurate capacity to localize the stimulated site, either verbally or on a body picture. In this case, it seems that an impaired proprioceptive sensori-motor body space can leave intact the body image. Conversely, with a centrally deafferented patient, J. Paillard has offered the first clinical observation of an equivalent of "blind sight" in the tactile modality, i.e. a location without perception (Paillard, Michel and Stelmach 1983). As a consequence of an occlusion of the left posterior cerebral artery, patient RS shows a partial deafferentation of her right arm (below the elbow) with complete preservation of her motor control. This patient was unable to perceive any tactile stimulation of her right hand but showed, to her own surprise, an ability to point her left finger toward stimulated places on her deafferented right hand. This patient thus shows an inability to use her body image, although her proprioceptive sensori-motor body space seems intact. The comparison between these two patients offers a double dissociation between consciousness of the body-as-object and consciousness of the body-as-subject: the first seems preserved and the second impaired in a

peripheral deafferentation, and, conversely, the first seems impaired and the second preserved in a central deafferentation.

Different authors following the phenomenological tradition have investigated closely the consciousness of the body-as-subject and have described this bodily experience as absolutely original compared with the body's relation to other experienced objects. As stated by Merleau-Ponty: "I observe external objects with my body, I handle them, examine them, walk around them, but my body itself is a thing which I do not observe: in order to be able to do so, I should need the use of a second body which itself would be unobservable" (1945, p. 107). "If I can , with my left hand, feel my right hand as it touches an object, the right hand as an object is not the right hand as it touches... In so far as it sees or touches the world, my body can therefore be neither seen nor touched. What prevents its ever being an object, ever being 'completely constituted' [Husserl] is that it is that by which there are objects. It is neither tangible nor visible in so far as it is that which sees and touches" (1945, p. 108).

Objects are experienced intentionally, identified and re-identified by their properties, and objectified as belonging to the external world. Conversely, the experiencing body has to experience itself *non*-intentionally (Maine de Biran 1804, Henry 1963). Indeed, any intentional act aiming at the body would transmute it into an experienced body, an intentional object of consciousness, thereby missing the body as specifically experienc*ing*. That the experience of the experiencing body is non-intentional means that it is not directed to the body as its intentional object. Non intentional consciousness thus corresponds here to pre-reflexive bodily consciousness, as defined above.

Crucially, this form of bodily consciousness is not restricted to a pure interiority, since this would fail to account specifically for the body as fundamentally intentional, that is, as an embodied being-in-the-world (Merleau-Ponty 1945). The body is intentional in the sense that it is the vehicule for being-in-the-world. To have a body is notably to entertain motor projects

in the world. For example, a subject facing an object to be grasped does not have to look for his hands. Rather, the latter are already mobilized as one end of intentional strings linked to the grasped object (Merleau-Ponty 1945). In a word, the intentional body is the body as subject of intentional consciousness.

The challenge is here to account for the experience of the body-as-subject that is both intentional and non-intentional. It is intentional in that it involves consciousness of some objects of the world, the body-as-object included. It is non-intentional in that it involves consciousness of the body as experiencing, that is, the body-as-subject. The body thus has a unique double involvement in consciousness: not only it can be both an object and a subject of consciousness, but also, as a subject, it experiences something (whether its own image or any other object) *intentionally* and is itself experienced *non-intentionally*. Hence the notion of a *non-intentional* consciousness of the *intentional* body. On the one hand, this notion takes into account the distinction between experiencing and experienced body, and does not reduce bodily consciousness to the experienced body-object (Maine de Biran 1804, Henry 1963). On the other hand, though, it also avoids to reduce the experience of the experiencing body to an act closed on itself, to an interiority (Merleau-Ponty 1945, Barbaras 1992). Rather, it acknowledges the intentional orientation of the body-subject towards perceived objects of the world. Thereby, the notion of non-intentional consciousness of the intentional body allows to go beyond the definition of the body as only an object, but also avoids to consider it as a pure subjectivity.

This notion is all the more interesting for us here since it manages to combine objective and subjective aspects of the body. Specifically, this peculiarity allows us to answer our core question: is bodily consciousness a genuine form of self-consciousness? We can see here that two elements that characterize immune self-consciousness characterize pre-reflexive consciousness of the body-as-subject as well. As stated above, immunity only characterizes

conscious states that combine non-identification of the subject and identification of some object. As far as pre-reflexive bodily consciousness is concerned, (1) the body can be experienced without being *identified* as an *object*; and (2) this "non-identifying" aspect is combined to an "identifying" aspect, since pre-reflexive bodily consciousness aims specifically at the experiencing body, that is linked intentionally to some identified objects.

On the basis of these two elements, pre-reflexive bodily consciousness can be adequately described as a form of immune self-consciousness, by contrast with the consciousness of the body that happens to be one's own. Pre-reflexive bodily consciousness does not imply any identification of the body-as-subject, and there is thus no room for any error of identification. Therefore, pre-reflexive bodily consciousness can be considered as immune, on logical grounds. Here, we thus join Evans who underlines that bodily predicates can also be immune: "the phenomenon appears to be more wide spread than the stock examples. For example, it seems equally not to make sense for a subject to utter «someone's legs are crossed, but is it I whose legs are crossed?», when the first component is expressive of knowledge which the subject has gained about the position of his limbs, available to him in the normal way" (1982, p. 216).

5 – Erroneous bodily consciousness.

Our investigation of pre-reflexive bodily consciousness allows us to conclude that bodily consciousness can be immune. However, this conclusion meets an important objection. Indeed, it can be argued that the two characteristics shared by immune self-consciousness and pre-reflexive bodily consciousness are insufficient to consider the latter as immune, since there exists many examples of erroneous bodily consciousness. A lot of them are erroneous consciousness of action. In the remaining of this paper, I will thus mostly focus on a sub-category of bodily self-consciousness, namely, action consciousness.

Several pathologies of awareness of one's body and action can be described, that seem to threaten immunity of bodily consciousness. One of these pathologies has already been mentioned above: deafferentation. In this case, action cannot be felt proprioceptively anymore. However, the patient knows when he acts and that the body he is conscious of is his own. Thus, this pathology is not a case of non-immunity of pre-reflexive bodily consciousness. Another pathology is often cited as a good example of non-immunity: schizophrenia. However, it has be argued (Gallagher 1999) that schizophrenic delusion of control does not prevent the patients to recognize their actions as their own, but "only" to identify correctly the source of them. Specifically, only the sense of agency, but not the sense of ownership, would be perturbed. Again, then, schizophrenia does not provide a convincing example of non-immune pre-reflexive bodily consciousness. As well for the "Anarchic hand" syndrome. Indeed, while here, contrary to schizophrenia, the anarchic hand's actions are disowned, the hand itself remains owned. Moreover, the disowned action is not attributed to anyone else, as it is the case in schizophrenia. Rather, the experience of the action as disowned is "only" a "seeming" (Marcel 2003). In fact, the "Alien hand" syndrome may seem to provide a better example of non-immune bodily consciousness (Brion and Jednak 1972, Bisiach, Rusconi and Vallar 1991). Indeed, in this pathology, what does not feel to be one's own is neither action control, nor action execution, but the hand itself.

Is such a pathology enough to disprove the application of the immunity principle to bodily properties? My answer will here be negative. Indeed, as stated by A. Marcel, "we are faced with the constant problem of what to infer from pathology, neurological or other: whether a psychological dissociation reveals a basic separation that is hidden by normal integrated functioning or whether it reflects an abnormal mode or some compensatory attempt to deal with this dysfunction" (Marcel 2003, p. 56). Pathological cases as alien hand are thus

insufficient to disprove "bodily immunity". However, these cases clearly cast doubt on it, and call for further investigations in normal subject.

Several studies have intended to show that normal subjects are less aware of their own action than it may seem intuitively. Fourneret and Jeannerod (1998) have shown that our proprioceptive awareness of the direction of our action is poor and Daprati et al. (1997) have shown that the attribution to oneself of one's action is not secured if visual feedback is manipulated. Using tendon vibration, Roll and Roll (1993) also show a dissociation between the felt location of the vibrated arm and its real location. On this basis, Marcel (2003) has shown that if the subject is asked to grasp his vibrated hand, the "grasped location" corresponds to the real location of the vibrated hand, and not to its illusory felt location. Moreover, subjects do not notice the disparity between felt and grasped locations. These data provide interesting results allowing to better understand which form of bodily consciousness is impaired in the pathological cases cited above. The idea here is that real location and grasped location would both correspond to a *non-observational* level, whereas felt location would correspond to an *observational* level, that is, to what was described above as the body image. Moreover, subjects would remain unaware of the disparity between these two different levels of bodily consciousness[3]. As well, verbal report on one's action direction (Fourneret and Jeannerod 1998) and action attribution (Daprati et al. 1997) would both correspond to the observational level.

To resume, the data on errors of body/action self-ascription reported here, whether on experimentally manipulated normal patients or on pathological cases, do not provide the right type of counterexample to the logical bodily immunity described above. Indeed, they do not refute on empirical evidences Evans' claim (1982) that there are ways of gaining knowledge about our physical properties that are immune. Simply, the reported cases of errors of body/action self-ascription do not involve specifically the "way" of gaining knowledge about

one's body/action that is said by Evans to be immune. Following this interpretation, pathology or experimental manipulations would prevent non-observational/pre-reflexive bodily consciousness and put the subject in an observational context. This is particularly clear in experimental conditions where the subject is asked "whose hand is this?". As stated by Marcel about anarchic hand, "the pathological condition makes the person an observer of their own action…this suggests that one only has observational knowledge of one's actions in particular states. In the pathological case, it is due to a restriction caused by removal of normal control. In the non-pathological case(s), it is by adoption of a certain attentional attitude, namely, by taking a detached stance in inspecting one's proprioceptive feedback" (2003, p. 87; cf. also Zahavi and Parnas 1999 for a comparable interpretation of some schizophrenic symptoms). In other terms, errors of body/action self-ascription would not suggest a disconnection between consciousness of one's body/action and consciousness of the body/action as one's own, but rather a disruption of the non-observational stance allowing pre-reflexive immune bodily self-consciousness.

To better interpret errors of body-ascription, we thus have to distinguish the objective relation of belonging (underlain by architectural constraints) from the epistemic relation of self-attribution, and we also have to avoid confusion between observational self-attribution and non-observational pre-reflexive self-consciousness. At this latter level, there is no place for the "*who*" question. This distinction between observational and non-observational bodily consciousnesses coheres with the above distinction between intentional and pre-reflexive bodily consciousness. Only the latter was described as logically immune given that it is identification-free. On the other hand, only the former is concerned by the reported cases of errors of body self-ascription. It can thus be concluded that the possibility of such errors do not imply that bodily self-consciousness relies on an identification of the body one is conscious of. However, given these errors, it seems worthwhile to refine our terminology and

to talk about immunity *under normal circumstances*, abnormal circumstances including neuro- and psycho-pathologies but also experimental manipulations of normal subjects, as described above.

At this stage, we can thus restate the conclusion drawn above: pre-reflexive bodily consciousness is a genuine form of self-consciousness, which combines seemingly paradoxical claims: (1) pre-reflexive bodily consciousness is logically immune and (2) bodily consciousness is not absolutely but circumstantially immune, that is, immune under normal circumstances.

This conclusion differs from Shoemaker's position. The latter is that bodily consciousness is both circumstantially and *de facto* immune. Rather, the present point is that bodily consciousness is both circumstantially and logically immune. As stated above (section3), for Shoemaker, in the case of bodily consciousness, immunity is ensured only thanks to architectural constraints, that is, only thanks to the link between a particular self and a particular body, which, *de facto*, allows the attribution of the latter to the former to be correct most of the time. Intrinsically, though, this process is fallible. Immunity is only secondary. On the contrary, the present account allows to determine a type of consciousness of the body-as-subject which is intrinsically immune, since it involves a process that is identification-free. It is circumstantial only insofar as this identification-free process can break down and be replaced by an observational consciousness of the body, which is not immune anymore, as evidenced by the reported cases of errors.

The present application of immunity to bodily consciousness cohere with Evans's who describes it as a powerful antidote to a dualist conception of the self (1982, pp. 215-222). Indeed, the description of a non-observational, pre-reflexive form of bodily consciousness argues against any substantive account of body ownership, implicitly reminiscent of an old Cartesian dualism and according to which we "have" a body but we "are" separated entities.

"Clearly this is a temptation to which the realist should refuse to succumb" (Cassam 1995, p. 327). Such a "temptation" is here avoided thanks to the consideration of bodily consciousness at a pre-reflexive level.

We are thus now in a position to follow the argument proposed in introduction of our investigation:

If (1) self-consciousness is constitutive of the self,

And if (2) bodily-consciousness is a form of self-consciousness,

Then (3) bodily self-consciousness is constitutive of (a part of) the self,

Which implies that (4) (part of) the body is (part of) the self. Hence the definition of a *bodily* self.

(1) has been accepted for the good of the argumentation. We just checked (2). Since immune bodily self-consciousness corresponds to the consciousness of itself by the bodily self, we conclude that we can define a *bodily self*, rather than only an embodied self.

6 – Identifying an underlying physiological mechanism of identification-free bodily self-consciousness.

At this step of our investigation, a further question arises. Until now, bodily self-consciousness has only been described negatively, that is, as non-reflexive, non-observational, identification-free. The question is now whether any positive description can be provided within a naturalistic framework. I will now attempt to provide an objective description of the physiological mechanism underlying pre-reflexive bodily self-consciousness. As above, I will focus here on a sub-category of bodily consciousness, namely action consciousness.

First, it has been argued that bodily self-consciousness must be based on a dedicated "attribution mechanism", a "*who*" system which would be reliable under normal circumstances, thus underlying circumstantial immunity. The existence of a dedicated "*who*"

system would imply that bodily self-consciousness is composed of two elements of the form: (1) "*x* is acting" and (2) "I am *x*" (De Vignemont and Fourneret 2004). However, the present account of pre-reflexive bodily self-consciousness is incompatible with both points. First, element (2) is an identification component as defined by Evans (1982). As such, thus, it cannot be compatible with the identification-free bodily self-consciousness defined here. Second, element (1) corresponds to a neutral representation of the agent "*x*". It is argued that such a representation would be evidenced by the recording of neuronal "shared representations". The recording of "mirror neurons" provides a nice example of such shared representations (Rizzolatti et al. 1996). In this case, they are representations of action activated when an agent is executing a given action as well as when it is observing other agents executing the same action. For the point at stake here, it has to be highlighted that these representations represent some features of the *action*, and not of the agent. These shared representations are indeed neutral, in the sense that the action is represented without being attributed to any agent, but not in the sense that the action is represented as being attributed to a neutral agent. What/who such a virtual agent would be? In fact, shared representation would better corresponds to "an action is performed", rather than to "x is acting". In other terms, shared representations are neutral in the sense that they represent "an" action rather than "my" action, "your" action or "*x*" 's action.

We can here conclude that pre-reflexive bodily self-consciousness does not rely on the association of (1) a neutral representation of an agent and (2) a dedicated "*who*" mechanism. In fact, once an agent is acting and perceiving, there is no room to ask the "*who*" question at a pre-reflexive level, since there is no neutral representation of the agent that would need a further qualification. The representation of the action "as a whole" is not neutral[4], nor does it includes a representation of a neutral agent. In other terms, actions are neither anonymous, nor *attributed* to oneself. Rather, they are intrinsically one's own. In coherence with the definition

of identification-free bodily self-consciousness, we see here that, at a pre-reflexive level, there is no representation of an agent as detached from its body/action. Thus, we have now to determine a physiological mechanism underlying pre-reflexive bodily self-consciousness *within* body/action representation, in a way fully compatible with naturalism. I will here consider a set of data from cognitive neurosciences in order to determine the neuro-physiological mechanism by which the body is neither absent nor present as an object, neither pure subjectivity, nor pure objectivity.

7 – The efferent sense of the bodily self.

An influential hypothesis is that the consciousness of one's actions would be attributed to the self thanks to one's intention preceding their execution. For C. Frith et al. (2000), for example, self-perception is notably based on the perception of actions as one's own, which in turn corresponds to the perception of actions as generated by an intention prior to their execution, by contrast with actions generated in response to external stimuli. This hypothesis insists on the fact that the relevant aspects of the system are "decoupled from reality": "the results of several studies suggest that this *prediction* [of sensory consequences of movement], which is based largely on the efference copy of the motor command, is available to awareness. The experiments … also suggest that the *actual* state of the motor system and the *actual* sensory consequences of a movement are normally unavailable to awareness. Furthermore, we seem to be unaware of the results of the comparison between the predicted and intended outcome of motor commands, and the comparison between the predicted and actual sensory feedback, as long as the desired state is successfully achieved" (Blakemore, Wolpert and Frith 2002, p. 237; I underline). In this framework, then, bodily self-consciousness would correspond to a *predicted* sense of self. Sensory consequences of the movement are taken into account only as they are predicted by the model, rather than as they

actually are after the execution of the movement. The self is here defined as the common denominator of self-initiated actions. There would be "a mean to recognize our [actions] as our own, as if each of our [actions] should have a label indicating that they belong to us" (Frith 1996, pp. 111-112). This label "self" would consist in one's intention to act, preceding one's action. In this case, there would be no need to wait for the verification of the intention by effective execution to validate self-perception.

The major problem of this position in the present context is that it implies that the self is conceived as the detached initiator of his action[5]. Such a conception, though, corresponds to what I called above an *embodied* self, while I intend to investigate here the *bodily* self. In other terms, here I do not conceive the self as a *label* that would be added (or not) to the action. The bodily self is not an entity detached from its action, and responsible of their initiation, that is, the bodily self is not an initiator of action, but an actor. Moreover, not only the characterization of the self as embodied does not correspond to what the self is, but also this does not correspond to our phenomenological sense of self. Indeed, we do not experience our action on the one hand and ourselves on the other hand. Rather, we experience ourselves as the subject/agent of our action. Thus, given the very definition of the bodily self, bodily self-consciousness cannot be based on the intention to act alone.

8 – The afferent sense of the bodily self.

Another hypothesis is suggested by the difficulty to provide an efferent foundation to pre-reflexive bodily self-consciousness: would it be afferent? This hypothesis considers that bodily self-consciousness would rest on a specific sense of the body, i.e. proprioception, which is supposed to be the sense of self "par excellence". Proprioception has diverse sources: muscular, vestibular, cutaneous and even visual receptors allow to perceive the body in a way or another. N. Eilan, A. Marcel and J.L. Bermudez (1995, p. 13) recall that many other

information participate to proprioception, such as information about pressure, temperature, posture, balance, nutritional and other homeostatic states, and so on. The relevant question here is in fact not really to establish an exhaustive list of proprioceptive information, but rather to consider if proprioception can itself underly immune pre-reflexive bodily self-consciousness or if it can only underlie consciousness of the body that happens to be one's own. This question will here be answered in two steps: (1) Is proprioception a form of perception; (2) Is proprioception a form of *self*-perception?

First, many authors debate about whether proprioception is a form of perception. Our answer here is that proprioception is a form of perception according to the following criteria (Proust 2003):

(a) Like other perceptual modalities, proprioception allows to grasp facts and objects of the spatial and qualitative varieties (e.g. the subject's legs being crossed) thanks to specialized captors (quoted above);

(b) Like other perceptual modalities, proprioception is phenomenological since a distinct qualitative feeling is normally associated to the perceived properties: there is something it feels like to experience that one's legs are crossed;

(c) Like other perceptual modalities, proprioception may be either veridical or illusory. Illusory proprioceptive states can be produced experimentally by tendon vibration: a motionless subject may in those modified conditions feel her head, trunk, or whole body rotate;

(d) Like other perceptual modalities, the objects of proprioception are independent from the fact that they are being perceived. A subject who feels her legs crossed picks up sensory information about an independent physical fact: the position of a limb is not constituted by the awareness of the subject whose body is involved.

Given this analysis, proprioception seems to naturally fall within the scope of perception (Proust 2003, Martin, 1995). Specifically, it must be underlined that, described as such, proprioception is a form of perception of an *identified* body. Precisely because of that, it cannot suffice to underlie *pre-reflexive* bodily self-consciousness. Thereby, proprioception in itself cannot be said to be a form of *self*-perception or self-consciousness in the sense at stake here.

Specifically, proprioception in itself is not enough for pre-reflexive self-consciousness for the following two raisons: (1) As underlined by Eilan et al. (1995), proprioception brings several types of information about either one's body alone (e.g. homeostatic information), or the relation between one's body and the world (e.g. vestibular information), or alternatively one's body and the world (e.g. touch). Eilan et al. conclude: "it is neither true that internal proprioceptive systems can provide information only about the body, nor is it true that information about the body comes only via the internal proprioceptive systems" (1995, p. 14). In this case, it seems hard to claim that proprioception suffices to establish a perception that concerns oneself *undoubtedly* and thus to base immune bodily self-consciousness on proprioception alone.

(2) Moreover, even if we restrict our consideration to those proprioceptive signals specific to one's body, they must be able to underlie a genuine form of bodily self-consciousness, as opposed to consciousness of the body that happens to be one's own. To perceive oneself as such cannot be limited to the processing of information that an external observer can differentiate from information on the non-self. Bermudez (1998) argues that the body concerned by proprioception is necessarily one's body, given architectural constraints. These architectural constraints are fundamental to consider. However, as already shown above (section 3), they cannot suffice to account for the perception of one's body as one's own, from the point of view of the organism itself, since these architectural constraints are not available

from this point of view. Without being available from a first-person perspective, these architectural constraints can only explain the fact of ownership, but not the sense of ownership. Thereby, proprioception itself can*not* be said to be the sense of self par excellence.

It is important here to underline that this conclusion can in fact be generalized to any information that is about one's body from the point of view of a third-person observer without necessarily being about one's body "from within". Again, we have to distinguish between obtaining information on oneself and perceiving oneself as such. The so-called "self specifying" information proves to be information that concerns the self since it is *de facto* linked with it, but it can at best be immune thanks to an identification that is correct in normal contexts. Thus they do not underlie an identification-free process on which pre-reflexive bodily self-consciousness relies.

The claim here is not that proprioception does not participate at all to bodily self-consciousness. Rather, it is that proprioception, as far as it is a form of perception of the identified body-as-object, cannot suffice in itself to underlie the identification-free consciousness of the body-as-subject. This conclusion thus joins Gallagher's (2000) definition of a non-perceptual awareness of one's body but departs from it since it argues that this consciousness of the body-as-subject cannot rely on any perceptual process alone, proprioception included. The role played by proprioception in the present account will be detailed below (section 9).

Before going further, the question arises here whether the present account coheres with empirical data suggesting that afferences play a major role in bodily self-consciousness. For example, Farrer et al. (2003) show that, when the visual feedback is biased, explicit recognition of movement direction is not impaired when normal subject "execute" a passive movement. They thus argue that proprioception is sufficient for action recognition, since no motor command can help in this experimental condition. Conversely, they show that

deafferented patient GL is impaired for the recognition of the conflict between movement done and movement seen, suggesting that proprioception is necessary, even when motor command is available. In the same vein, Fourneret et al. (2002) show that, for GL, action correction remains possible even when visual feedback is perturbed, but that explicit consciousness of the bias between action done and action seen is impaired. This patient is only conscious of the difficulty of the task, of an increased demand of attentional control on its movement. In fact, these experiments provide an interesting result for us in that they underline a double dissociation between (1) action attribution and explicit recognition and (2) action execution and non-observational consciousness of the action. These results suggest that (1) is not possible without proprioception whereas (2) remains possible without proprioception. In other terms, these results imply that a lack of proprioception is not sufficient to impede non-observational consciousness of the action/body, thus suggesting that non-observational bodily self-consciousness is not rooted in proprioception alone.

9 – The sensori-motor sense of the bodily self.

Given the failure of the purely efferent and the purely afferent hypotheses, I will now try to determine an underlying mechanism of pre-reflexive bodily consciousness[6]. For that, I first need to come back to the very definition of the bodily self: the self at the bodily level is the body itself. It is not a "ghostly" instigator or observer of action, *de facto* linked to a specific body, but the body as it is acting and perceiving, that is, the body *as the point of convergence of action and perception*. Given this, to experience actions as one's own at a pre-reflexive level does not mean to attribute them to a self that would have initiated them, or that would observe them afterwards. Rather, at a bodily level, to be pre-reflexively self-conscious means *to experience action and perception as coherent*.

Numerous studies have investigated the ability to experience action and perception as coherent by relying on the ability to discriminate between self-stimulation and external stimulation, i.e. between perceptual modifications due to one's action and perceptual modifications due to the movement of an observed object of the world. For example, Rochat and Hespos (1997) have observed the rooting reflex which is the response the new-born gives to the stimulation of his cheek: he turns his head in the direction of the stimulation. The authors have contrasted two conditions: the first is a "double touch" where hand and cheek touch each other, and the second is a "simple touch" where only the cheek is touched by an external stimulus. They showed that the rooting reflex is three times more frequent in response to an external stimulation than in response to a self-stimulation (For other data from developmental psychology, cf. e.g. Butterworth 1999). For the authors, "such discrimination [between self-stimulation and external stimulation] is fundamentally self-specifying as it involves proprioception, a perceptual system that conveys first and foremost information about the body and its situation in the environment. Proprioception in conjunction with other perceptual systems, is indeed the modality of the self "par excellence" (Rochat and Striano 2000, pp. 516-7).

We saw above that proprioception is *not* the modality of the self "par excellence". The suggestion of Rochat et al. is that such a grounding would be provided by proprioception "in conjunction with other perceptual systems". Their hypothesis is thus that the sense of self would rely on a multi-sensorial integration. In this framework, the question is the following: how sensorial inter-modality can underlie bodily self-consciousness whereas proprioception can only underlie consciousness of the body that happens to be one's own? The solution proposed by Rochat et al. is that sensorial inter-modality implies a redundancy of information which would be specific of one's own body. The key here would be the invariance of the correlations between different sensorial information on oneself. Specifically, each time a

perception is self-generated, that is, generated by one's own movement, it is accompanied by proprioceptive information, as a sensorial feedback of the movement that has generated the perception. This invariant correlation is specific of the self, and would thus be self-specifying. For them, the origin of one's bodily sense of self would thus be primary, perceptive, and pluri-modal.

However, I would like to underline that if one follows this "multi-sensorial" hypothesis, the question that arises concerns the criterion that allows to assess the coherence of sensorial information. First, it has been shown that a strict spatio-temporal correspondence between the diverse sensorial modalities is not needed. For example, the subjects continue to recognize a movement observed visually as their own despite the introduction of a temporal perturbation of 150 ms or an angular perturbation of 15 degree of the visual feedback (Franck et al. 2001). Another possibility is prediction: proprioception would allow to predict other sensory information resulting from the action, such as the modification of the visual field. For example, it is well known that a self-generated stimulus is perceived as less intense compared to an externally generated stimulus: this is why one cannot tickle oneself (Weiskrantz, Elliot and Darlington 1971). On this basis, it has been shown that if a perturbation of the sensory feedback decreases its predictability, the perceived difference between self-generated and externally generated stimulation decreases too (Blakemore, Frith and Wolpert 1999). Other experiments, however, challenge this hypothesis. Indeed, it has been shown (Tsakiris and Haggard 2003) that, compared with externally-generated stimuli, the perception of predictable self-generated stimuli as less intense is only present if the self-stimulating action is voluntary, rather than passive. This study allows to conclude that predictibility is not the relevant criterion that allows to assess the coherence of sensorial information. Rather, these experiments highlight the crucial role of agency.

The role of agency in bodily self-consciousness is also suggested by the fact that the processing of proprioceptive information is modulated by the intentional context of a prior action (Tsakiris and Haggard 2003, Tsakiris and Haggard 2004). Specifically, a so-called "binding mechanism" links the perception of an action (consciousness of its time onset) and the perception of its sensory consequences, including proprioceptive consequences, only if the stimulus-generating action is intentional. Moreover, it has been shown (Haggard and Clark 2003) that an uncompleted intention does not lead to such an "intentional binding". Indeed, if the intentional preparation is present, but does not play its normal role in causing the action and its sensory consequences, the intentional binding cannot be observed.

These different results imply that the sense of our body cannot be adequately conceived as purely sensorial, be it proprioceptive or multi-sensorial: agency plays a crucial role. These results also imply that the opposite hypothesis is not adequate either: the sense of one's body cannot be anchored to intention alone. Rather, bodily consciousness requires a specific match between (1) the intention, (2) the motor consequences of this intention, i.e. the executed action, and (3) the sensorial consequences of this action, including proprioception, but also exteroception. We saw above that proprioception alone cannot underlie pre-reflexive bodily consciousness. Here, we add that proprioception indeed plays a crucial role, in that it is integrated to information on the intention. This integration ensures that the proprioceptive information becomes truly self-specifying, since it then becomes meaningful "from within". Unlike the architectural link allowing the (most of the time correct) attribution of a given bodily information to a given self, the integration allowing the matching between the intention, the action, and its sensorial consequences supports an immune bodily self-consciousness in that it is an identification-free process. Proprioceptive information does not have to be architecturally linked to an embodied self. Rather, the bodily self is here understood as an integrated system characterized by a matching of sensori-motor information.

A single information, be it afferent or efferent, detached from this integrated system, cannot carry in itself the self-specification. The latter is only due to the integrative process which does not suppose any identification of the self. Hence, the conception of the self as bodily, as defined above.

10 – Bodily self-consciousness and action monitoring.

At this stage, the remaining question is: how are intention, action and perception integrated so as to underlie adequately pre-reflexive bodily self-consciousness? To answer this question, lets first recall that here bodily self-consciousness means consciousness of the body as the point of convergence of action and perception, i.e., consciousness of perception and action as coherent. Specifically, the contemporary literature in cognitive sciences supports the idea that a mechanism of sensori-motor integration called "action monitoring" allows to experience one's action as one's own, that is, as coherent with one's perception. This mechanism of action monitoring allows to distinguish between, on the one hand, perceptual modifications due to one's actions leading to apparent modifications of external stimuli, and, on the other hand, perceptual modifications due to real modifications of external stimuli. Clearly, action monitoring does not underlie consciousness of an *embodied* self conceived as the initiator of action. Rather, it underlies consciousness of a *bodily* self conceived as the body itself characterised by its specific perceptual and motor activities.

The description of the mechanism of action monitoring is based on a model first developed by Von Holst (1954). Schematically, it consists in a comparator between a copy of the motor command (information on the action executed) and the sensorial reafferences (information on the perceptual modifications due to the action). Through such a mechanism, the organism can register the fact that it has executed a given movement, and uses this information to process resulting perceptual modifications (cf. Fig. 1).

This model has been sophisticated to include intention and an internal model allowing to predict the perceptual consequences of the action (Wolpert, Ghahramani and Jordan 1995; Blakemore, Frith and Wolpert 1999). A comparator between intended, predicted and real reafferences is thus added to the comparator between efference and afference. Although I do not deny the importance of such an internal model, my claim differs from Frith's since it implies the integration of efference with actual afferences, rather than with predicted afferences (Cf. section 7). The present position is more akin to what Frith calls "action monitoring" than to what he calls "intention monitoring". While he describes self-consciousness as relying on the latter, the present position would rather describe self-consciousness as relying on the former.

The present proposition that pre-reflexive bodily self-consciousness relies on action monitoring has to be differentiated from the position defended by J. Russell (1995) who also relies on this mechanism to explain what he calls "self-world dualism". Self-world dualism would come from the capacity to distinguish two types of reality: an objective reality represented as independent from oneself and a subjective reality constituted by one's representations. It thus notably consists in the ability to differentiate between self-generated and externally generated stimuli. For Russell, agency would play a major role in this ability. In this framework, agency corresponds to the capacity to control and reverse one's actions at will. This voluntary control of action would allow the organism to experience the link between voluntary actions and their perceptual consequences, and to contrast them with externally generated perceptual modifications, the latter being irreversible because of the refractoriness of the world. The more the action is determined at will and controlled, the more it can be contrasted with the refractory world, the more, thus, the organism would experience the self as distinct from the world.

Though Russell's means and goal are very similar to the one I tackle and use here, our respective positions differ at least on an important point: free will. Whereas Russell places free will at the core of his understanding of self-world dualism, my position is more economical since it does not need such a sophisticated ability. Indeed, contrary to Russell, I do not base bodily self-consciousness on the reversibility of one's action at will. Rather, I base my account of bodily self-consciousness on the mechanism of action monitoring itself. The reason why this mechanism is enough in my account is that it is not only fundamental for action control and correction but also for perceptual discrimination between self-stimulation and externally generated stimulation. My point is that this ability is nothing less than pre-reflexive bodily self-consciousness, that is, consciousness of the body in terms of coherence of action and perception. In effect, this type of self-consciousness is very basic, but this is what I am looking for. Indeed, the key here is to abandon the idea of "a" self as something embodied, perceptible. Rather, my account argues in favour of a bodily "selfless self", in that the self at the bodily level would "only" be the body itself considered in its dynamical coherence, that is, as a sensori-motor unity anchored to its world. At this level, there is no room for action attribution nor for explicit body ownership, that is, there is no room for the "*who*" question, and thus no need for a "*who*" system. Rather, the content itself of perception specifies the agent/perceiver[7].

11 – Anchoring bodily self-consciousness to the world.

The position defended here implies that self-consciousness is fundamentally anchored to the consciousness of the world. As also described above, self-specifying information are not enough to determine self-consciousness, as opposed to consciousness of the body that happens to be oneself. Conversely, to perceive the world as coherent with one's action on it

constitutes one's bodily consciousness of oneself. Self-consciousness here looses it privacy, that is, its closure.

The openness of self-consciousness to world-consciousness is also coherent with some data recalled above. For example, many experiments describe sensory suppression, the process by which self-stimulation is perceived as *less* intense than externally generated stimulation. This implies that, during action, consciousness is focused on the reaching of the goal, rather than on the mean to reach it. We understand here that this is in fact were pre-reflexive bodily self-consciousness is rooted: in the way one perceives the goal, and in the way this perception varies coherently with one's action.

It is interesting to compare this position with Gibson's (1979) who has famously claimed that self and world are co-perceived directly. The term "affordance" was introduced to account for the fact that the environment is perceived in relation to the perceiver's motor capacity. An affordance can thus be considered as an information that concerns the world relatively to the perceiver. Bermudez (1998) has exploited this view and described affordances as a primary form of self-perception. However, it has to be clarified that affordances differ from information that concerns the perceiver itself. Contrary to what Bermudez (1998) claims, affordances are not self-*specifying* information but self-*relative* information. Thus, this notion of affordance cannot be relevant to defend a position arguing that bodily self-consciousness relies on self-specifying information. If affordance is a primary form of self-perception, it rather implies a role of self-relative information about the world. This is what the present account of bodily self-consciousness suggests too. Indeed, pre-reflexive bodily self-consciousness is characterized by the way information (notably about the world) coheres with one's action, that is, the way information is self-relative (Perry 1998).

It is important to underline that the present position does not intend to restrict bodily consciousness to action consciousness. as said above, action consciousness is considered here

as a sub-category of bodily consciousness, but the bodily self is not limited to the acting self. However, crucially, the process involved in pre-reflexive action consciousness can be generalized to other forms of pre-reflexive bodily self-consciousness. Indeed, the key point here is to recognize the possibility of an identification-free self-consciousness intrinsic to any act, whether it be motor, as developed here, or perceptual, as briefly stated about affordances. The present proposition here joins Evans' when he describes an immediate awareness of oneself as an information-gainer and experiencing subject: "any informational state in which the subject has information about the world is *ipso facto* a state in which he has information about himself… It is of the utmost importance to appreciate that in order to understand the self-ascription of experience we need to postulate no special faculty of inner sense or internal self-scanning… For what we are aware of, when we know that we see a tree, is *nothing but a tree*. In fact, we only have to be aware of some state of the world in order to be in a position to make an assertion about ourselves" (1982, p.230-1). The experience of the seen tree can be said to be a form of pre-reflexive self-consciousness in the sense that its content is not the self, but the tree. We find here again the idea that, in Perry's terms (1993), pre-reflexive self-consciousness is self-relative without being self-referential.

12 – Conclusion.

Putting together the different results of the present investigation, we end up with a peculiar position: (1) bodily immunity to error through misidentification is both logical and circumstantial and (2) bodily self-consciousness is open rather than private. We thus see here that immunity is not linked exclusively to privacy. Rather, it can be detached from privacy in two ways: first, by being applicable to bodily state; second by the consideration of bodily consciousness as anchored to world consciousness. This position leads to the understanding of the self as bodily, that is as the body conceived as a dynamical sensori-motor coherence.

Notes

1. Another possible strategy consists in the investigation of the constitution of the self in a bottom-up evolutionary way, that does not imply any *a priori* association of self with self-consciousness (cf. Legrand 2004).

2. Specifically, parts of the body do not lead to bodily consciousness and part of self-consciousness is not (or at least not directly) a bodily consciousness.

3. The disparity between these two levels is also suggested at a perceptual level, and is related to the so-called "what/where" dichotomy. (Milner and Goodale 1995).

4. Mirror neurons represent neutrally the "part of" the action that is common between the agent and the other, but of course they do not represent the whole action.

5. Note that Frith's position also implies that the intention to act would be prior to action. By contrast, an increasing set of data suggests that intention would depend on, and even be anchored to action execution (Livet 1997, Grammont, Legrand and Livet (Eds) in preparation).

6. Note that the described mechanism is not taken to be sufficient and necessary in every case of bodily self-consciousness. Rather, it is taken as only a very plausible candidate, given the current knowledge in cognitive neuroscience. I let here open the empirical question whether there exists other possible mechanisms.

7. The link we propose here between bodily self-consciousness and action monitoring allows to refine the search for neuronal correlates of self-consciousness. Several experiments using neuro-imaging techniques intend to determine the neuronal correlates of action monitoring. It has been shown that the cerebellum plays a role in the prediction of the sensory consequences of movement (Blakemore, Wolpert and Frith 1998). Other experiments suggest that the parietal lobe would be a good candidate for the "neural signature" of self-consciousness (Newen and Vogeley 2003; Legrand 2003). More specifically, and in coherence with the

present hypothesis, it has been shown (Leube et al. 2003) that detecting mismatches between one's movement and their visual consequences mainly relies on a fronto-parietal network in the right hemisphere. Two conditions must be met for the activation of this Fronto-Parietal network: (1) self-attribution of an observed movement must be established, and (2) these relationship must be violated. Fink et al. (1999) have specifically investigated the "locus" of action monitoring, and show that the right dorso-lateral pre-frontal cortex is activated when action done and action seen conflict, and that the right mid-ventral-pre-frontal cortex is activated when movement felt proprioceptivelly and movement seen conflict.

Reference List

Barbaras, R. 1992. De la phénoménologie du corps à l'ontologie de la chair. In J.C. Goddard and M. Labrune (Eds.), *Le corps*, (pp. 242-280. Vrin.

Bermudez, J.L. 1998. *The paradox of self-consciousness.* The MIT Press.

Bisiach, E., Rusconi, M.L., and Vallar, G. 1991. Remission of somatoparaphrenic delusion through vestibular stimulation. *Neuropsychologia*, *29*, 1029-1031.

Blakemore, S.J., Frith, C.D. and Wolpert, D.M. 1999. Spatio-temporal prediction modulates the perception of self-produced stimuli. *J Cogn Neurosci, 11*, 551-9.

Blakemore, S.J., Wolpert, D.M. and Frith, C.D. 2002. Abnormalities in the awareness of action. *Trends in Cognitive Science*, *6*, 237-242.

Blakemore, S.J., Wolpert, D.M. and Frith, C.D. 1998. Central cancellation of self-produced tickle sensation. *Nat Neurosci, 1*, 635-40.

Brewer, B. 1995. Bodily awareness and the self. In J.L. Bermudez, A. Marcel, & N. Eilan (Eds.), *The body and the self.* (pp. 291-309). The MIT Press.

Brion, S. and Jednak, C.P. 1972. Troubles du transfer interhémisphérique (callosal disconnection). A propos de trois observations de tumeurs du corps calleux. Le signe de la main étrangère. *Revue Neurobiologique, 126,* 257-266.

Butterworth, G. 1999. A developmental - ecological perspective on Strawson's 'the self'. In S. Gallagher and J. Shear (Eds.), *Models of the self,* pp. 203-211. Imprint Academic.

Cassam, Q. 1995. Introspection and bodily self-ascription. In J.L. Bermudez, A. Marcel and N.E. Eilan (Eds.), *The body and the self*, pp. 311-336. The MIT Press.

Castaneda, H.N. 1966. He': A study in the logic of self-consciousness. *Ratio, VIII,* 130-157. Reprinted in A. Brook and R.C. De Vidi (Eds) 2001. *Self-reference and self-awareness*, Advances in Consciousness Research, 30, Amsterdam: John Benjamins Publ. Co.

Daprati, E., Franck, N., Georgieff, N., Proust, J., Pacherie, E., Dalery, J. and Jeannerod, M. 1997. Looking for the agent: an investigation into consciousness of action and self-consciousness in schizophrenic patients. *Cognition, 65,* 71-86.

De Vignemont, F. and Fourneret, P. 2004. The sense of agency: a philosophical and empirical review of the "who" system. *Consciousness and Cognition, 13,* 1-19.

Dokic, J. 2003. The sense of ownership: an analogy between sensation and action. In J. Roessler & N. Eilan (Eds.), *Agency and self-awareness.* (pp. 321-344). Oxford: Oxford University Press.

Eilan, N., Marcel, A. and Bermudez, J.L. 1995. Self-consciousness and the body: an interdisciplinary introduction. In J.L. Bermudez , A. Marcel and N. Eilan (Eds.), *The body and the self*, pp. 1-28. The MIT Press.

Evans G. 1982. *The varieties of reference.* Oxford: Oxford University Press.

Farrer, C., Franck, N., Paillard, J. and Jeannerod, M. 2003. The role of proprioception in action recognition. *Consciousness and Cognition, 12,* 609-619.

Fink, G.R., Marshall, J.C., Halligan, P.W., Frith, C.D., Driver, J., Frackowiak, R.S. and Dolan, R.J. 1999. The neural consequences of conflict between intention and the senses. *Brain, 122(Pt 3),* 497-512.

Fourneret, P. and Jeannerod, M. 1998. Limited conscious monitoring of motor performance in normal subjects. *Neuropsychologia, 36,* 1133-40.

Fourneret, P., Paillard, J., Lamarre, Y., Cole, J. and Jeannerod, M. 2002. Lack of conscious knowledge about one's own actions in a haptically deafferented patient. *Neuroreport, 13(4),* 541-547.

Franck, N., Farrer, C., Georgieff, N., Marie-Cardine, M., Daléry, J., D'Amato, T. and Jeannerod, M. 2001. Defective recognition of one's own actions in schizophrenic patients. *Am J Psychiatry., 158 (3),* 454-9.

Frith, C. 1996. *Neuropsycholgie cognitive de la schizophrénie.* Paris: PUF.

Frith C.D., Blakemore S.J. and Wolpert D.M. 2000. Abnormalities in the awareness and control of action. *Philos Trans R Soc Lond B Biol Sci., 355 (1404),* 1771-88.

Gallagher, S. 2000. Non-perceptual Awareness of one's body. Colloquium on phenomenological and empirical approaches to cognition (Paris).

Gallagher, S. 1999. Self-reference and schizophrenia: a cognitive model of immunity to error through misidentification. In D. Zahavi and J. Parnas (Ed.), *Problems of the self.* Amsterdam and Philadelphia: John Benjamins.

Gallagher, S. 1995. Body schema and intentionality. In J.L. Bermudez, A. Marcel and N. Eilan (Eds.), *The body and the self.* A Bradford Book. The MIT Press.

Gallagher, S. 1986. Lived body and environment. *Research in phenomenology, 16,*139-170.

Gallagher, S. and Marcel, A.J. 1999. The self in contextualized action. *Journal of consciousness studies, 6,* 273-300. Also published in S. Gallagher and J. Shear (Eds) Models of the Self, Imprint Academic.

Gibson, J.J. 1979. *The ecological approach to visual perception.* Boston: Houghton Mifflin.

Grammont, F., Legrand, D. and Livet, P. In Preparation. *Naturalizing intention in action.* MIT Press.

Haggard, P. and Clark, S. 2003. Intentional action: conscious experience and neural prediction. *Consciousness and Cognition, 12,* 695-707.

Head, H. and Holmes, G. 1911-1912. Sensory disturbances from cerebral lesions. *Brain, 34,* 102-245.

Henry, M. 1963. *L'essence de la manifestation.* Paris: PUF.

Legrand, D. 2004. Problèmes de la Constitution du soi. *Thèse de Doctorat en Philosophie de l'Université Aix- Marseille I.*

Legrand, D. 2003. How not to find the neural signature of self-consciousness. *Consciousness and Cognition, 12,* 544-546.

Leube, D.T., Knoblich, G., Erb, M. and Kircher, T.J. 2003. Observing one's hand become anarchic: an fMRI study of action identification. *Consciousness and Cognition, 12,* 597-608.

Livet, P. 1997. Modèles de la motricité et théorie de l'action. In J.L.E. Petit (Ed.), *Les neurosciences et la philosophie de l'action,* pp. 341-361. Paris: Vrin.

Maine de Biran. 1804. *Mémoire sur la décomposition de la pensée.* Paris: Vrin (éd. F. Azouvi, 1988).

Marcel, A. 2003. The sense of agency: awareness and ownership of action. In J. Roessler and N. Eilan (Eds.), *Agency and self-awareness,* pp. 48-93. Oxford: Oxford University Press.

Martin, M.G.F. (1995). Bodily awareness: a sense of ownership. In J.L. Bermudez , A. Marcel, & N. Eilan (Eds.), *The body and the self.* (pp. 267-289). The MIT Press.

Merleau-Ponty, M. 1945. *Phénoménologie de la perception.* Paris: Tel Gallimard.

Milner, A.D. and Goodale, M.A. 1995. *The Visual Brain in Action.* Oxford: Oxford University Press.

Newen, A. and Vogeley, K. 2003. Self-representation: searching for a neural signature of self-consciousness. *Consciousness and Cognition, 12,* 529-543.

Paillard J. 1999. Body schema and body image - a double dissociation in desafferented patients. In G.N. Gantchev, S. Mori and J. Massion (Eds.) *Motor Control ,Today and Tomorrow,* pp. 197-214.

Paillard, J. 1980. Le corps situé et le corps identifié. Une approche psychophysiologique de la notion de schéma corporel. *Rev. Méd. Suisse Romande, 100,* 129-141.

Paillard, J., Michel, F. and Stelmach, G. 1983. Localization without content. A tactile analogue of 'blind sight'. *Arch Neurol, 40,* 548-51.

Perry, J. 1998. Myself and I. In M.Stamm (Ed.), *Philosophie in synthetisher absicht,* pp. 83-103. Stuttgart: Klett-Cotta.

Perry, J. 1993. *The problem of the essential indexical and other essays.* New-York: Oxford University Press.

Proust, J. 2003. Perceiving intentions. In J. Roessler and N. Eilan (Eds.), *Agency and Self-Awareness: Issues in Philosophy and Psychology*. Oxford: OUP.

Rizzolatti, G., Fadiga, L., Gallese, V. and Fogassi, L. 1996. Premotor cortex and the recognition of motor actions. *Brain Res Cogn Brain Res, 3,* 131-41.

Rochat, P. and Hespos, S.J. 1997. Differential Rooting Response by Neonates: Evidence for an Early Sense of Self. *Early Development and Parenting., 6, 2, 150,* 1-8.

Rochat, P. and Striano, T. 2000. Pereived self in infancy. *Infant Behavior and Development, 23,* 513-530.

Roll, J.P. and Roll, R. 1993. Le sentiment d'incarnation: arguments neurobiologiques. *Revue de médecine psychosomatique, 35,* 75-90.

Russell, J. 1995. At two with nature: agency and the development of self-world dualism. In J.L. Bermudez, A. Marcel and N. Eilan (Eds.), *The body and the self,* pp. 127-151. The MIT Press.

Shoemaker, S. 1996. On knowing one's own mind. In Shoemaker S. (Ed.), *The first person perspective and other essays*, pp. 25-49. Cambridge University Press.

Shoemaker, S. 1986. Introspection and the self. *Midwest studies in philosophy, X,* 101-120. Reprinted in S. Shoemaker (Ed). 1996. *The first person perspective and other essays*, pp. 3-24, Cambridge University Press; and in Q. Cassam (Ed). 1994. *Self-knowledge*, pp. 118-139, Oxford, Oxford University Press.

Shoemaker, S. 1984. Personal identity: a materialist's account. In S. Shoemaker and R. Swinburne (Eds.) *Personal identity*. Oxford Basil Blackwell.

Shoemaker, S. 1968. Self-reference and self-awareness. *Journal of philosophy, 65,* 555-567. Reprinted in Shoemaker, S. (Ed.) *Identity, cause and mind*, Cambridge, Cambridge University Press; and in Q. Cassam (Ed.) *Self-knowledge*, pp. 80-93, Oxford, Oxford University Press.

Tsakiris, M. and Haggard, P. 2004. Experimenting with the acting self. Cognitive Neuropsychology, In Press.

Tsakiris, M. and Haggard, P. 2003. Awareness of somatic events associated with a voluntary action. *Exp Brain Res., 149 (4),* 439-46.

Von Holst, E. 1954. Relations between the central nervous system and the peripheral organs. *The British Journal of Animal Behavior, 2,* 89-94.

Weiskrantz, L., Elliot, J. and Darlington, C. 1971. Preliminary observations of tickling oneself. *Nature, 230,* 598–599.

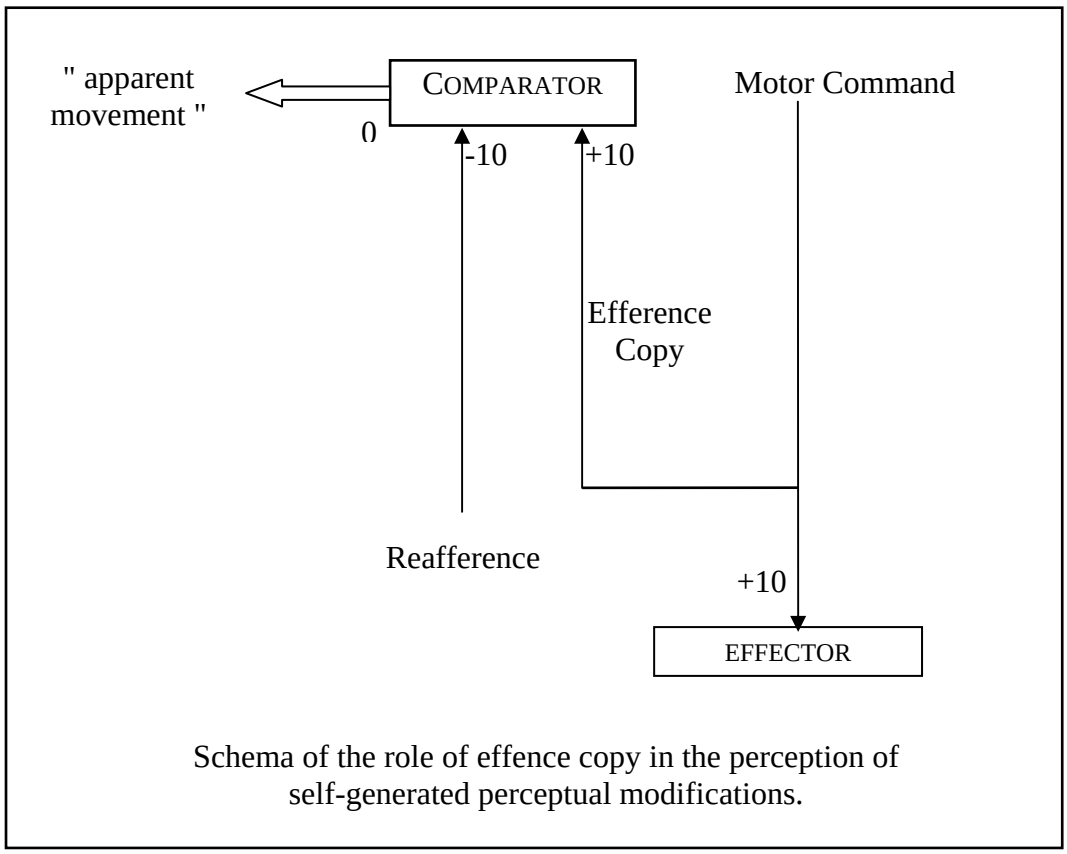
Wittgenstein, L. 1958. *Preliminary studies for the "Philosophical Investigations". Blue and Brown Books.* Gallimard (Ed. 1996).

Wolpert, D.M., Ghahramani, Z. and Jordan, M.I. 1995. An internal model for sensorimotor integration. *Science, 269,* 1880-2.

Zahavi, D. 2003. Phenomenology of self. In T. Kircher & A.David (Eds.), *The Self in Neuroscience and Psychiatry*. Cambridge University Press.

Zahavi, D. and Parnas, J. 1999. Phenomenal consciousness and self awareness: a phenomenological critique of representational theory. In S. Gallagher and J. Shear (Eds.), *Models of the self*, pp. 253-270. Imprint Academic.

FIGURE 1



Schema of the role of effence copy in the perception of self-generated perceptual modifications.